SOFIA UNIVERSITY ST. KLIMENY OHRIDSKI

FACULTY: Physics

CURRICULUM

Approved by: .....

Approved by the Academic Council with Record of Proceedings
№ ....8..... / ..28.02.2024.

Professional Field: 4.1 Physics

Educational and Qualification Degree: „Master"

Area of Study: "Nuclear technology and nuclear power"

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/Master's Degree Program: " Nuclear power and technology"

Form of Study: full time
Length of Study (number of weeks*/-): 45 weeks (3 semesters)

Professional Qualification: **Master of Physics Engineer in Nuclear Power and Technologies**

Qualification Description

Master's Degree Program: *Nuclear technology and nuclear power*

1. Aims and Educational Objectives

The Master's program "Nuclear Energy and Technologies" is aimed at training students who have a bachelor's degree in professional field "4.1. Physical Sciences", as well as students who have a BA "Nuclear Chemistry" and "Nuclear Energetics" majors. The aim of the program is to build interdisciplinary specialists in the fields of nuclear energy, radiation protection and radioecology, measurement, research and use of ionizing radiation and radionuclides in industry, science, technology and medicine. The program has been compiled and is extremely suitable for continuing education of students who have received a bachelor's degree in nuclear engineering and nuclear energy.

One of the goals of training in the master's program is for the prepared specialists to build not only professional qualities, but also moral foundations for responsibility towards their work and the decisions they make.

The curriculum is in accordance with the requirements of the Nuclear Regulatory Agency for training in a specialty in the field of nuclear energy. For this purpose, candidates who have not completed the bachelor's program "Nuclear Technology and Nuclear Power" of the Faculty of Physics of the University of Sofia must, in the process of their studies, undergo training in the special courses taught in the bachelor's degree of this specialty.

2. Admission of students (knowledge and skills required for a successful professional realization; general and theoretical background, specific areas of study, etc.)

The program is mainly intended for specialists who have completed the Bachelor's program "Nuclear Technology and Nuclear Power"(NTNP) of the Physics Faculty of Sofia University. Students with a bachelor's degree in professional field "4.1. Physical Sciences" of the Faculty of Physics of the Sofia University, as well as students who have a bachelor's degree in "Nuclear Chemistry" or "Nuclear Energy".

Admission conditions are determined by the Regulations of the University of St. Kliment Ohridski for admission to the Master's College.

3. Description of the educational content (knowledge and skills required for a successful professional realization; general and theoretical background, specific areas of study, etc.)

The engineer-physicist who has completed the Master's program "Nuclear Power and Technologies" (NPT) will acquire a broad fundamental training from the taught theoretical and applied disciplines, as well as solid professional knowledge in the field of specialization. An additional condition for successful completion is to be highly motivated for professional development and improvement.

The broad-based preparation is obtained from the engineering-physics orientation of the master's program, in which the following are balanced:

- basic nuclear physics disciplines such as Neutron Physics, Physics of Nuclear Reactors, Experimental Nuclear Physics, Dosimetry and Radiation Protection, Nuclear Electronics, Introduction to Nuclear Technologies, Computational Methods in Nuclear Technologies;
- specialized theoretical and applied disciplines such as operational reactor physics and nuclear safety, reactor analysis, radiochemistry, metrology of ionizing radiation;
- engineering-applied courses such as Thermal Physics of NPP, Technical Hydromechanics, Reliability in Nuclear Energy, Reactor Materials in NPP;

These compulsory disciplines, the set of elective courses, and the development and defense of a master's thesis or the successful appearance of a state exam, give a complete look to the educational program.

Additional elective and optional courses are provided for students without a bachelor's degree in NTNP

4. Professional and general competences, specific competences

Masters in "Nuclear Power and Technologies" must be able to:

- conduct research, improve or develop physics-related concepts, theories, practical methods, instrumentation or software;
- conduct experiments, tests and analyzes of the structure and properties of matter in fields such as mechanics, thermodynamics, electronics, communications, power generation and delivery, aerodynamics, optics and lasers, remote sensing, medicine, technological use of sound, magnetism and nuclear physics;
- evaluate results of conducted studies and experiments and draw conclusions using mathematical techniques and models;
- apply principles, techniques and processes to develop or improve industrial, medical, military and other practical applications and techniques of physics;
- advise and consult with medical practitioners and other health professionals to optimize the balance between the beneficial and harmful effects of radiation;
- develop, implement and maintain standards and protocols for the measurement of physical phenomena and for the use of nuclear technologies for industrial and medical purposes;
- prepare scientific reports and reports.

5. Professional realization (according to the National Classification of Occupations in the Republic of Bulgaria /based on the International Standard Classification of Occupations (ISCO)/ and in reference to the place of the future specialists in the National Qualifications Framework for higher education and the European Qualifications Framework for higher education)

According to the "National Classification of Professions and Positions in the Republic of Bulgaria", the main opportunity for realization is by classifier "Physicists and Astronomers". Also, professional realization can be found according to the "ORDINANCE on the conditions and procedure for acquiring

a professional qualification and on the procedure for issuing licenses for specialized training and certificates of legal capacity to use nuclear energy", of the Nuclear Regulatory Agency (NRA) , where a set of positions in the nuclear power industry that could be filled by the graduates of the NPT master's program is defined. These positions include:

- Head of a structural unit responsible for nuclear safety control of a nuclear power unit or nuclear power plant
- Head of a structural unit responsible for radiation protection or emergency preparedness of a nuclear power unit or a nuclear plant
- A qualified expert in radiation protection at a nuclear power plant
- Operational personnel of research reactors
- Management staff of research reactors

According to the national classification for professional realization, these positions correspond to "Managerial positions".

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Area of Study "Nuclear technics and nuclear power (NTNP)" / Master's Degree Program "Nuclear power and technologies" (NPT),
3 semesters, ful-time training

admission winter semester of 2024/2025 academic year

№	Course Code	Course Title	Type- C, E, O	Semester	ECTS credits	Classes - total number					Classes per week	Assessment* - e, ca, ce, cont.
						Total	Lectures	Seminars	Practical Classes/ Observation	Self study		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Core Subjects												
1	M 1 0 1	Technical hydromechanics	C	1	6	180	45	15	0	120	3+1+0	CA
2	M 1 0 2	Reliability in nuclear power	C	1	6	180	45	15	0	120	3+1+0	E
3	M 1 0 6	Metrology of ionizing radiation	C	1	6	180	30	0	30	120	2+0+2	E
4	M 1 0 7	Reactor materials in the NPP	C	1	6	180	45	0	15	120	3+0+1	CA
5	M 1 0 4	Operational Reactor Physics and Nuclear Safety-1	C	1	6	180	45	15	0	120	3+1+0	E
6	M 1 0 5	Reactor analysis	C	2	9	270	45	45	0	180	3+3+0	E
7	M 1 0 3	Radiochemistry	C	2	7.5	225	30	0	45	150	2+0+3	CA
8	M 0 9 9	Operational Reactor Physics and Nuclear Safety-2	C	2	6	180	45	15	0	120	3+1+0	E
9	M 1 0 0	Thermal physics of nuclear power plants	C	3	4.5	135	30	15	0	90	2+1+0	E
Elective Courses – the chosen electives have to contribute to minimum 18 Credits. During the second and thirs semester is allowed to elect cource form other master's degree programme. Selection is approved by the head of programme.												
1	N 0 3 3	One-time course on current issues of nuclear technology and engineering*	E	2/3	3.0	90	15	0	0	75	1+0+0	CA
3	H 1 4 3	Nuclear fuel cycle**	E	2	5.0	150	45	30	0	75	3+0+0	E
4	H 1 3 0	Physics of nuclear reactors**	E	2	4.0	120	30	30	0	60	2+2+0	E
5	M 1 0 9	Methods of non-destructive testing of materials	E	2	6.0	180	45	0	15	120	3+0+1	E
6	M 1 1 4	Fundamentals of Engineering	E	2	6.0	180	30	0	30	120	2+0+2	E
7	H 1 2 1	Introduction to Nuclear Technology**	E	2	8.5	255	30	30	60	135	2+2+4	E

8	E	1	7	3	Monte Carlo modeling of the interaction of ionizing radiation with matter	E	2	4.5	135	30	15	0	90	2+1+0	E
9	N	0	4	9	Licensing of nuclear fuel in industry	E	2	3.0	90	15	0	0	75	1+0+0	И
10	M	1	0	8	Environmental radioactivity and radioecology	E	3	10.5	315	60	0	45	210	4+0+3	E
11	H	1	5	1	Nuclear electronics**	E	3	7.5	225	45	0	45	135	3+0+3	E

Optional courses: *There is recommended for the students to elect at least one cource per semester*														
1	N	0	3	3	One-time course on current issues of nuclear technology and engineering*	O	1	3	90	15	0	0	75	1+0+0	CA
2	H	0	0	2	Nuclear Power Plants**	O	1	4.0	120	30	15	0	75	2+1+0	E
3	H	0	1	5	Experimental nuclear physics**	O	1	7	210	45	0	45	120	3+0+3	E
4	H	1	4	2	Neutron Physics**	O	2	5.5	165	45	30	0	90	3+2+0	E
5	H	0	2	0	Computational methods in nuclear technology**	O	2	5.5	165	45	0	30	90	3+0+2	E
6	E	1	2	6	Physics of nuclear fission	O	3	3.0	90	45	0	0	45	3+0+0	E
7	M	1	1	1	Nuclear Electronics 2	O	3	9	270	45	0	45	180	3+0+3	E
8	E	1	0	6	Dosimetry and radiation protection**	O	3	9	270	60	0	60	150	3+0+4	E
9	И	0	9	5	Absolute dating methods	O	3	4.0	120	30	0	30	60	2+0+2	E

*The course program is announced at the beginning of the current semester

**Elective and optional courses must be chosen by students accepted under the NPT program, but who did not take the relevant disciplines at FzF-SU during the students with relevant degree do NOT elect these cources

Degree Completion

Form of degree completion	ECTS credits	First State Exam Session	Second State Exam Session
State Exam in Nuclear Power and Technology or public master's thesis defence (with average score of semmestrial study 4.0)	**15**	**March**	**July**

The curriculum has been approved by the Faculty Council, Record of Proceedings № 17/12.12.2023

DEAN:.....

Sofia University "St. Kliment Ohridski"

Curriculum Reference Statement

Area of Study "Nuclear technics and nuclear power (NTNP)" / Master's Degree Program "Nuclear power and technologies" (NPT)
form of study full time length of study: 3 Semesters

Course hours, ECTS credits and number of grades per semester																									
Type of courses	I семестър			II семестър			III семестър			IV			V			VI			VII			VIII			IX			X			Общо		
	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades
compulsory courses	300	30.0	5	225	22.5	3	45	4.5	1																					570	57.0	9
min. elective courses	0	0.0	0	112.5	7.5	2	####	###	2																					270	18.0	4
optional courses	45	3.0	1	82.5	5.5	1	45	3.0	1																					173	11.5	3
internships																																
Total:	300.0	30.0	5.0	337.5	30.0	5.0	####	###	3.0																					840	75.0	13

Form of degree completion	ECTS credits	Study Hours	First State Exam session	Second State Exam Session
State Exam in Nuclear Power and Technology	15	450	March	July
Defence of a Master thesis	15	450	March	July

Acquired Professional Qualification: Master of Physics Engineer in Nuclear Power and Technologies

Record of Proceedings of the Faculty Council № 17/12.12.2023

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